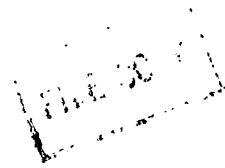


WPS-349



Asia Regional Office,
Country Department V
The World Bank
February 1990
WPS 349

How Indonesia's Monetary Policy Affects Key Variables

Sadiq Ahmed
and
Basant K. Kapur

Because of unrestricted capital movements, interest rate parity conditions prevail in Indonesia. To some extent, inflation can be reduced by slowing the growth of money. A managed float is appropriate for maintaining a competitive exchange rate. And real depreciation is needed to compensate for unanticipated decline in oil income.

The Policy, Research, and External Affairs Complex distributes PRE Working Papers to disseminate the findings of work in progress and to encourage the exchange of ideas among Bank staff and all others interested in development issues. These papers carry the names of the authors, reflect only their views, and should be used and cited accordingly. The findings, interpretations, and conclusions are the authors' own. They should not be attributed to the World Bank, its Board of Directors, its management, or any of its member countries.

This paper — a product of the Country Operations Division, Asia Regional Office, Country Department V — seeks to determine the appropriate management of macroeconomic policies and their impact on key macroeconomic variables in developing countries. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Joyce Rompas, room A10-023, extension 73723 (26 pages with graphs and tables).

The movement toward greater trade liberalization in Indonesia has generated debate about the effect of monetary policy on interest, inflation, and exchange rates.

Admitting the limits of using a short-run model, Ahmed and Kapur report the following findings of their econometric analysis:

Unlike many developing countries, Indonesia has an open capital account. Its monetary policy must therefore be coordinated with other policies aimed at managing the balance of payments — in particular, policies on interest rates.

In the short term, monetary policy can be used to protect domestic interest rates from the destabilizing influence of speculative capital flight. In the long run, monetary policy can help lower domestic nominal interest rates by maintaining low inflation and dampening expectations about depreciation. The potential for

reducing interest rates through monetary expansion is limited.

Domestic inflation is partly a monetary phenomenon but structural factors also affect it. The main structural variables are the domestic price of imports and the price of rice (used as a proxy for wage adjustments). The effects of international inflation are immediate and strong; the effects of wage pushes are smaller and less immediate.

Inflation can be reduced to some extent by slowing the growth of money — which strengthens the secondary influence of a slower crawling exchange rate.

A managed float is appropriate for maintaining a competitive exchange rate, given the gap between world and domestic inflation caused by structural and monetary factors. Real depreciation of the exchange rate will be necessary to compensate for unanticipated decline in oil income (from lower than expected oil prices).

The PRE Working Paper Series disseminates the findings of work under way in the Bank's Policy, Research, and External Affairs Complex. An objective of the series is to get these findings out quickly, even if presentations are less than fully polished. The findings, interpretations, and conclusions in these papers do not necessarily represent official policy of the Bank.

TABLE OF CONTENTS

	<u>PAGE NO.</u>
A. INTRODUCTION	1
B. RECENT TRENDS IN INFLATION, INTEREST AND EXCHANGE RATES	2
C. CONCEPTUAL FRAMEWORK	11
D. EMPIRICAL EVIDENCE AND POLICY IMPLICATIONS	14
E. CONCLUDING REMARKS	24
 BIBLIOGRAPHY	 26

This working paper was prepared for the Macroeconomic Management Study, as background input to the 1989 Economic Report for Indonesia. Sadiq Ahmed is a senior economist with the World Bank's resident office in Jakarta. Basant K. Kapur (consultant) is an associate professor with the National University of Singapore. We would like to thank Professor William Branson, Professor John Harris, William Easterly and Ajay Chhibber for helpful comments.

A. INTRODUCTION

1. A key characteristic of the Indonesian economy distinguishing it from many other developing countries at comparable per capita income level is its open capital account. Since 1970, Indonesia has lifted most barriers to private international capital flows.^{1/} On the other hand, restrictions on the current account still remain significant, notwithstanding progressive trade liberalization in recent years. The exchange rate regime was officially moved from a fixed rate to a crawling peg since November 1978. Effectively, however, the exchange rate remained virtually unchanged vis-a-vis the US Dollar to the end of 1981. But the flexibility of the nominal exchange rate has increased substantially since March 1983. In June 1983, a major financial sector reform removed controls over domestic interest rates. Since 1979, Bank Indonesia has also offered a limited swap facility to partially compensate for the lack of an active forward exchange market. These features of the Indonesian economy have generated a strong debate concerning their implications for three key macroeconomic variables -- interest rate, inflation and exchange rate -- and the role of monetary policy in their determination. The debate has been specially intense on the implications of the rise in real interest rates following the deregulation measures of June 1983. At issue also is whether monetary policy can be used to target domestic interest rates.

2. The objective of this paper is to examine the determination of interest rate, inflation and nominal exchange rate in Indonesia, and investigate the role of monetary policy in affecting these variables. A short-term monetary model is constructed to empirically verify the relevant determinants. The short-term nature of investigation is imposed by the fact

^{1/} See Njoman Sriwidjana (1983).

that the market determination of the interest rate has been effectively allowed only since June 1983. Furthermore, as noted, the flexibility of the exchange rate gained momentum in the 1983-87 period, reflecting the Government's strategy to pursue an incentive exchange rate policy to stimulate non-oil exports.

3. The paper is organized as follows. In order to provide an appropriate country-context to the specification of the functional relationships, Section B reviews recent trends in interest rate, inflation and exchange rates and underlying key policy initiatives. In Section C the theoretical underpinnings of the empirical structure are briefly discussed. The econometric results are then presented in Section D, drawing implications for policy. Finally, some concluding remarks are contained in Section E.

B. RECENT TRENDS IN INFLATION, INTEREST AND EXCHANGE RATES

4. Indonesia's policy response to the oil booms of 1973-74 and 1979-80 has generally been rated favorably relative to comparators.^{2/} Nevertheless, a number of disquieting features prevailed which in the later years magnified the adjustment burden resulting from the collapse of the oil prices.^{3/} First, on average, the real effective exchange rate tended to appreciate.^{4/} In conjunction with substantial trade protection, this led to a strong anti-export bias, causing non-oil exports to suffer. Secondly, relatively high

^{2/} See, Alan Gelb (1988).

^{3/} A recent review of Indonesia's adjustment performance is contained in Sadiq Ahmed (1989).

^{4/} The exchange rate was devalued in November 1978 to protect export incentives. However, the real depreciation did not last very long. See Peter Warr (1986).

inflation rates prevailed, contributing to the appreciation of the real exchange rate. Thirdly, nominal interest rates were largely controlled resulting in negative real rates, which hurt employment, reduced the efficiency of capital and stimulated capital flight. However, the Indonesian Government initiated a major turnaround in policies following the first signs of a deterioration in the external environment. Starting in early 1983, the competitiveness of the exchange rate was considerably enhanced and the exchange rate was made more flexible, interest rates were decontrolled and steps were taken to slowdown inflation.

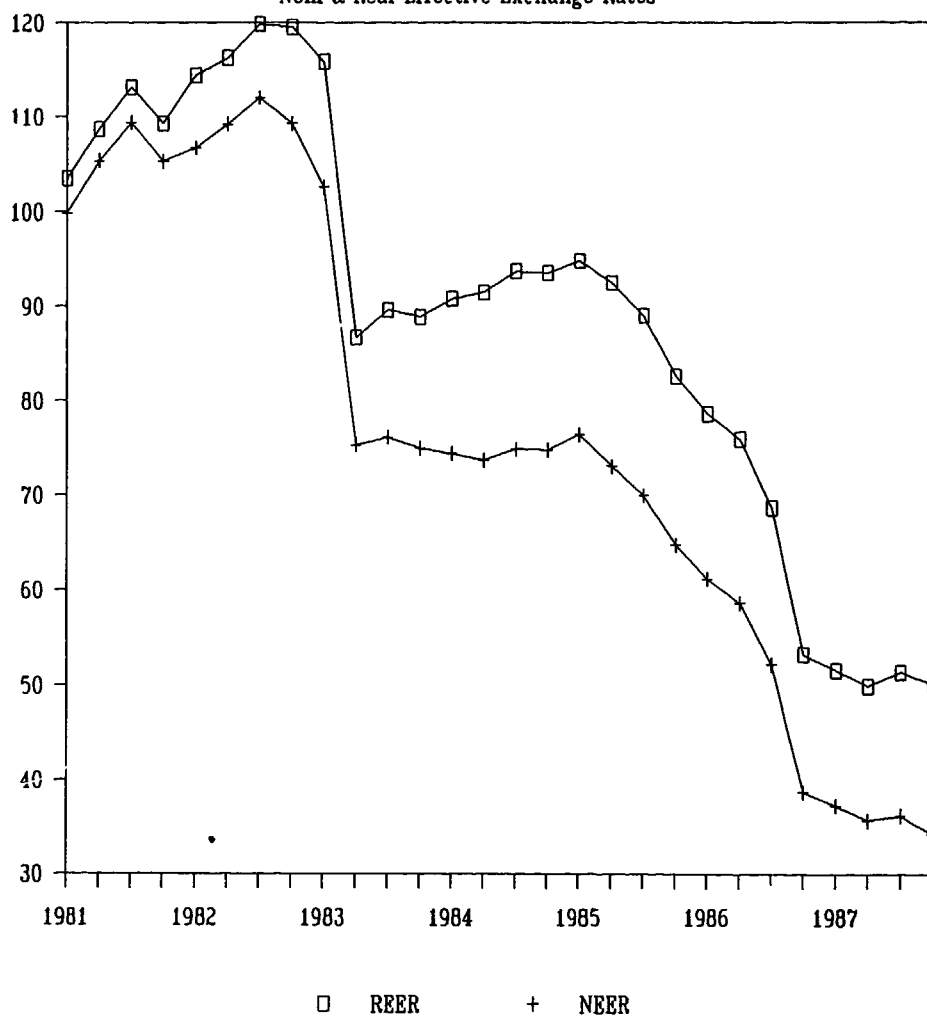
5. The key policy initiatives are summarized below:

- (a) Exchange Rate Management: A first step was to implement a devaluation of the Rupiah by 38% ^{5/} in March 1983. The Rupiah was again devalued by 45% in September 1986, in response to the collapse of the oil prices. Since then, the Rupiah has been allowed to depreciate against a falling US Dollar. The trend of nominal and real effective exchange rates is shown in Graph 1. As a result of two maxi-devaluations, a managed float policy and the Government's ability to restrain inflation, Indonesia's real effective exchange rate depreciated by about 55% between December 1981 and December 1987. Except for a brief reversal in 1984, the downward trend of the real effective exchange rate has generally prevailed.

^{5/} The usual definition of currency depreciation (rate of change of the rupiah value of the dollar) is used throughout this paper.

GRAPH 1 : INDONESIA

Nom & Real Effective Exchange Rates



REER : Real Effective Exchange Rate
NEER : Nominal Effective Exchange Rate

- (b) Fiscal Policy: To restrain aggregate demand, substantial fiscal policy measures were initiated. The main steps were: a major tax reform starting in January 1984; follow-up steps to strengthen tax administration; rephasing of large projects and general cutbacks in public spending; a freeze on civil service salaries since 1985; and tight control maintained since 1984 on the use of non-concessional import-related credits. These measures resulted in a reduction of the fiscal deficit, restraining demand pressures on both the balance of payments and prices.
- (c) Monetary and Financial Policies: A major turnaround happened in monetary and financial policies. The Government recognized the importance of keeping inflation low to maintain a competitive exchange rate. Moreover, given the openness of the capital account, the need to prevent capital flight by ensuring the attractiveness of holding domestic currency deposits was also recognized. To this end, and to improve financial resource mobilization and the efficiency of allocation of financial resources, a major reform of the financial sector was initiated in June 1983. There were three main aspects of the reform.^{6/} First, interest rate and credit ceilings for state banks (the dominant financial sector operator) were basically removed.^{7/} Secondly, the role of Bank Indonesia in financing special credit programs at low interest rates was curtailed. Thus,

^{6/} See: Thomas F.T. Balino and V. Sunderarajan (1986).

^{7/} Interest ceilings for priority sector credit have remained in force. Private sector banks were not subject to interest and credit ceilings even before the reform.

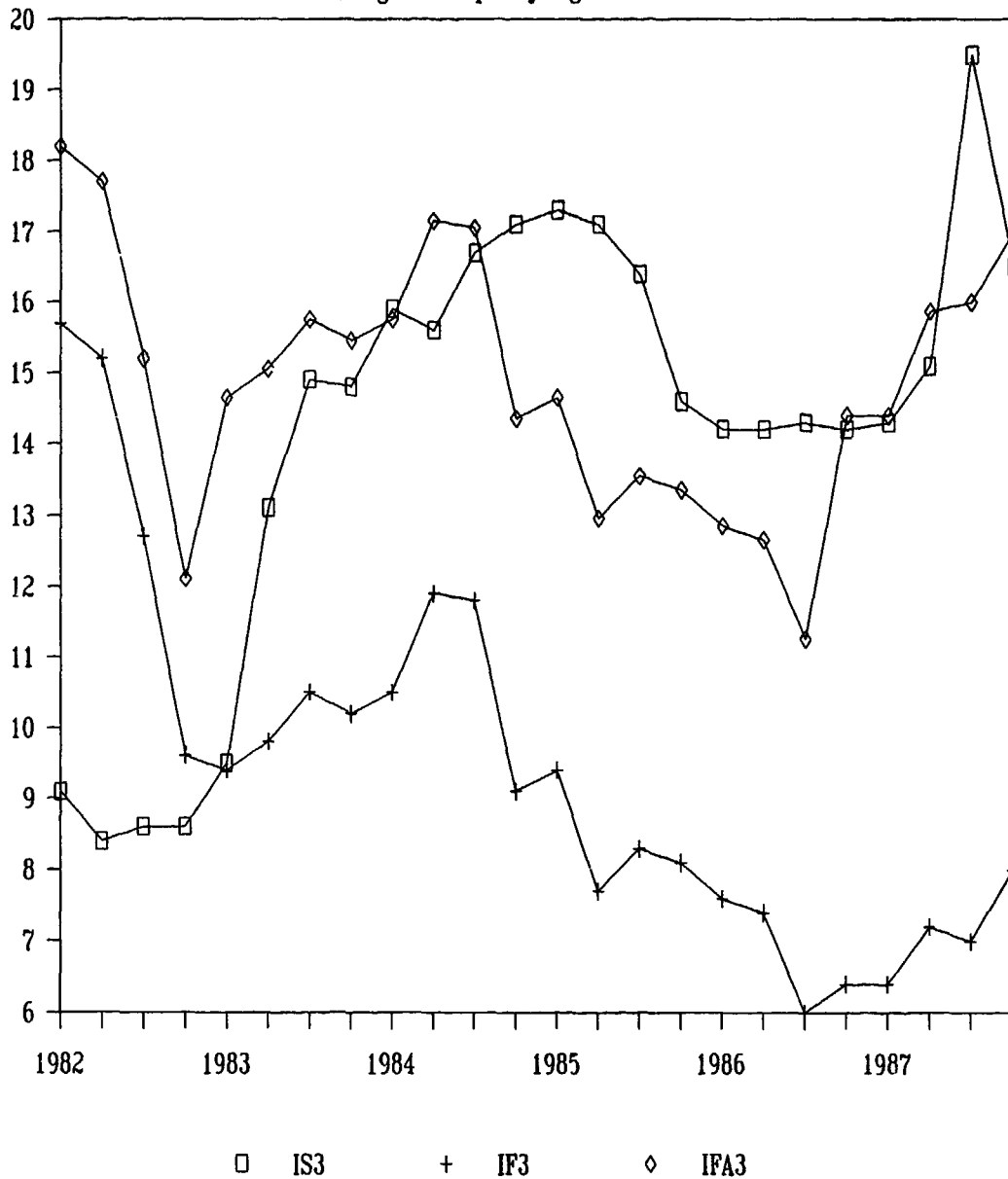
the number of priority programs was reduced and associated lending rates were simplified. Thirdly, the Government introduced new tools of monetary management, designed to assist monetary control and improve money market operations. Following the deregulation of interest and credit ceilings, the focus of monetary control was shifted to reserve money management through open market operations. To support this new direction, two instruments of monetary control -- rediscount facilities and Bank Indonesia certificates (SBI) -- were introduced in February 1984. Subsequently, to improve flexibility of the money market, a new money market instrument (SBPU) was introduced in February 1985. Apart from these measures, the Government's monetary expansion targets were generally focussed on maintaining low inflation rates.

6. Recent trends in interest rate and inflation are illustrated in Graphs 2 and 3, while movements in key financial variables are shown in Table 1. The main points are as follows. First, nominal interest rates have risen substantially following decontrol in June 1983; real rates have become significantly positive (See Table 2). Second, there has been a noticeable increase in financial deepening, as reflected in the ratios of quasi-money (QM) and total money (M2) to GDP.^{8/} Thus, positive real interest rates have helped to mobilize financial savings. Third, the average inflation rate has fallen while real money supply has increased, indicating an increase in the demand for real money balances. Thus, on the whole, monetary and fiscal policies have assisted in reducing inflation, despite two large discrete devaluation, but without requiring a liquidity crunch.

^{8/} QM/GDP and M2/GDP ratios increased from 6.7% and 16.1% respectively during 1978-82 to 13.8% and 24.5% in 1983-87.

GRAPH 2 : INDONESIA

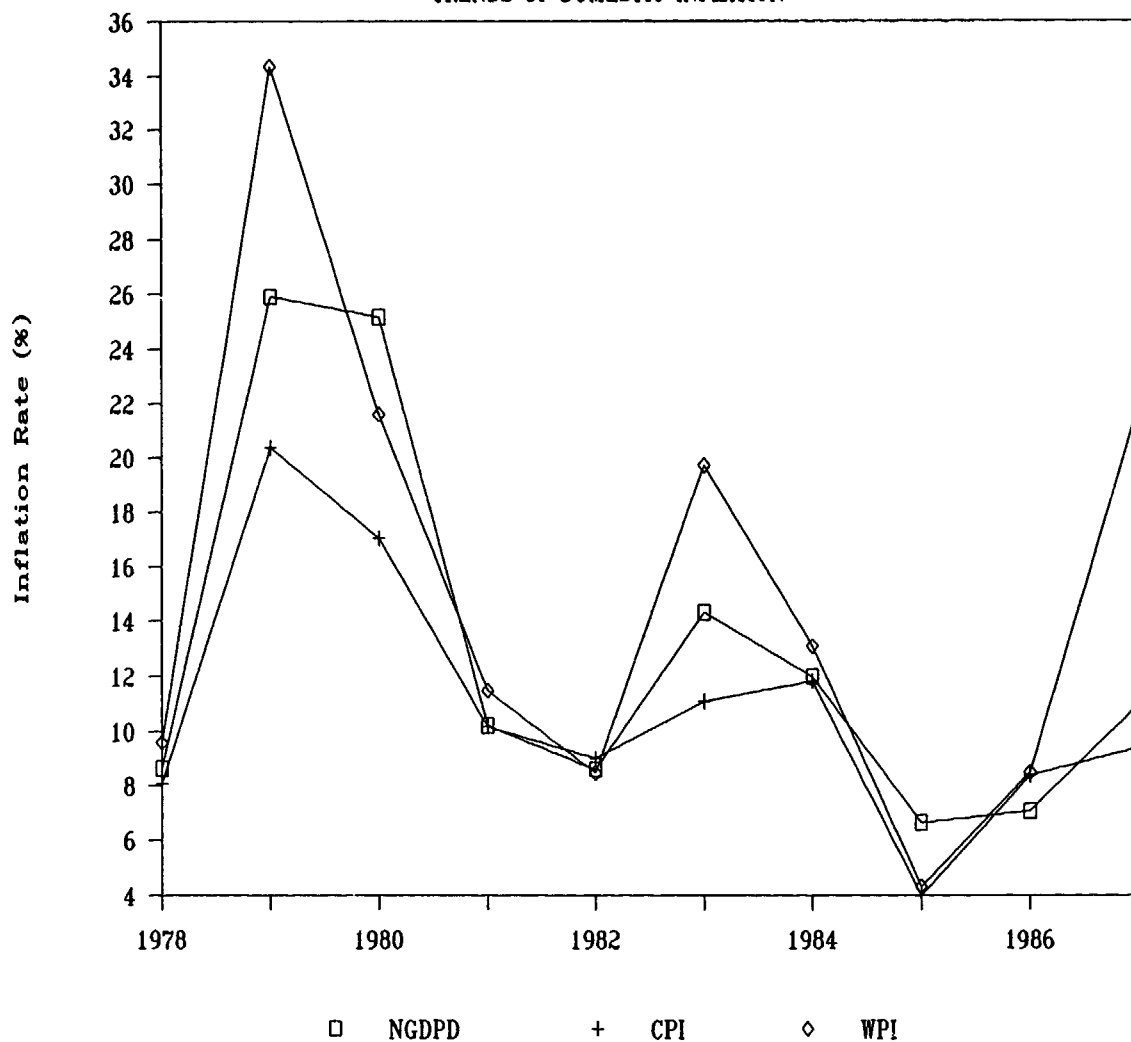
Dom, Frgn & Swap-adj Frgn Int Rates



IS3 3-month state bank's deposit rate
IF3 3-month LIBOR rate
IFA3 IF3 + BI 3-month swap rate

GRAPH 3 :INDONESIA

TRENDS OF DOMESTIC INFLATION



NGDPD Non-oil GDP deflator
CPI Consumer Price Index
WPI Wholesale Price Index

Note: The acceleration in WPI during 1979, 1983 and 1987 reflect the direct effect of devaluation in those years.

Table 1: KEY FINANCIAL VARIABLES

Date	RM	M1	QMD	M2	NFABI	INTEB	DISC	SBPU	SBI
		(in Rp. trillion)					(in %)		
1982.1	4.01	6.78	2.23	9.00	4.10	17.1	-	-	
1982.2	3.91	7.17	2.34	9.50	3.25	18.0	-	-	
1982.3	4.08	7.59	2.43	10.02	3.20	17.3	-	-	
1982.4	4.00	7.12	2.54	9.66	3.65	16.3	-	-	
1983.1	4.07	7.38	2.78	10.16	2.96	17.9	-	-	
1983.2	4.27	7.51	3.42	10.93	3.78	10.5	-	-	
1983.3	4.71	7.72	3.98	11.70	4.14	10.6	-	-	
1983.4	4.89	7.57	4.80	12.37	4.78	13.7	-	-	
1984.1	5.34	8.05	5.28	13.33	6.24	16.4	17.5	-	
1984.2	5.51	8.18	5.87	14.05	7.20	14.0	16.5	-	
1984.3	5.54	7.96	5.81	13.77	6.80	46.8	26.0	-	
1984.4	5.47	8.58	6.40	14.98	7.60	9.6	21.0	-	16.7/17.5
1985.1	5.83	8.99	7.14	16.13	7.87	13.2	21.0	20.5	17.0
1985.2	6.14	9.43	7.98	17.41	7.98	9.2	21.0	19.5	-
1985.3	6.14	9.41	9.16	18.57	8.02	10.2	18.5	17.0	-
1985.4	6.44	10.10	9.67	19.77	8.48	11.5	18.5	17.0	15.0
1986.1	7.55	10.47	9.89	20.36	8.16	15.2	18.5	17.0	15.0
1986.2	7.09	10.35	10.63	20.98	7.69	12.7	18.5	17.0	15.0
1986.3	7.26	11.19	11.61	22.80	11.76	12.9	18.5	17.0	15.0
1986.4	7.81	11.67	11.39	23.07	8.34	14.8	18.5	17.0	15.0
1987.1	7.99	11.50	12.42	23.92	9.30	15.0	18.5	17.0	15.0
1987.2	7.79	11.59	12.79	24.38	9.14	17.8	19.5	19.0	15.0
1987.3	7.89	11.97	15.37	27.34	10.88	16.1	20.3		
1987.4	8.65	12.68	16.54	29.22	11.38	11.9	18.7		

Glossary:

- RM = reserve money
- M1 = currency and demand deposits
- QMD = saving and time deposits
(excluding foreign currency deposits)
- M2 = M1 + QM
- NFABI = net foreign assets of Bank Indonesia
- INTEB = weighted-average inter-bank rate
- DISC = Bank Indonesia's basic discount rate
- SBPU = discount rate on SBPU
- SBI = cut-off rate on 90-days SBI auctions.

7. The Policy Debate. The rise in the real interest rate has generated a serious concern about its adverse effect on private investment. Reflecting this, there is an ongoing policy debate in Indonesia concerning ways the real interest rate could be brought down. The debate is particularly intense

Table 2: DOMESTIC INTEREST RATES, 1981-88
(annual averages; % p.a.)

	1980	1981	1983	1984	1985	1986	1987
Deposit rates /a	6.0	6.0	14.6	18.0	14.5	14.6	17.0
Real deposit rates /b	- 11.0	-10.7	2.8	7.5	9.8	8.8	7.5
Average lending rates (all banks) /c	15.0	15.0	18.7	23.0	20.5	20.2	21.2
Real lending rates /d	- 10.0	4.8	4.4	11.0	13.9	13.1	11.4

/a 6 month deposit rate of state banks

/b Using CPI-17 cities as deflator

/c Weighted average interest rates for non-priority credits

/d Using non-oil GDP deflator

Source: Bank Indonesia and World Bank staff estimates.

regarding the appropriate role of monetary policy in determining domestic interest rates. A second issue is the persistent downward trend of the nominal exchange rate and its impact on inflation. Finally, also at issue is the role of monetary policy in controlling inflation. On the one hand, inflation is considered to be primarily determined by structural forces (rice price behavior, exchange rate changes, international inflation). On the other hand, it has been argued that inflation is purely a monetary phenomenon.

C. CONCEPTUAL FRAMEWORK

8. The openness of the capital account and the decontrol of domestic interest rates since June 1983 suggest that Indonesia is an attractive case to test the relevance of the monetary approach to the balance of payments, broadly conceived.^{9/} Two of the fundamental principles involved in this approach are a stock-adjustment view of the monetary mechanism, and attention to the monetary linkages between the domestic and external sectors. In the stock adjustment view, a monetary disequilibrium is gradually dissipated over time through a number of channels. Depending on the characteristics of the economy, the channels may involve linkages between interest rate, inflation and the exchange rate. A stylized model is presented below.

Stylized Model

9. Schematically, our system of equations has the following structure:

$$(1) \quad M1R = f_1(GDP, i)$$

$$(2) \quad QMR = f_2(GDP, i)$$

$$(3) \quad i_d = f_3(i_f, d_1)$$

$$(4) \quad MM = f_4\left(\frac{QM}{M1}, i\right)$$

$$(5) \quad DNFA = f_5(ESM, d_2)$$

$$(6) \quad INFR = f_6(IMPC, MON, d_3)$$

$$(7) \quad DEP = f_7(INFR, d_4)$$

^{9/} See J.A. Frenkel and H.G. Johnson(1976).

$$(8) \quad MB = NFA + DC$$

$$(9) \quad MM = \frac{M1 + QM}{MB}$$

Equations (1) and (2) are fairly standard demand functions for real M1 and real quasi-money (QMR), with i being a vector of possible rates of return on various assets (including the expected inflation rate). Equation (3) specifies a dependence of a domestic interest rate or rates (i_d) on foreign interest rates (i_f) and a vector of other possible variables (d_1): it thus captures the open capital account dimension by allowing i_f to influence i_d .^{10/} In equation (4) MM denotes the money multiplier, and in equation (5) DNFA denotes the change in net foreign assets: it responds to monetary disequilibrium (ESM denoting the excess supply of money) through the latter's effect on capital and current account flows, and to other possible variables (d_2). In equation (6), the inflation rate INFR is a function of import price changes (IMPC), of monetary variables (MON - specified more fully below), and of other possible ('structuralist') variables d_3 . The managed rate of exchange rate depreciation, DEP, in equation (7) is assumed to be responsive to the inflation rate, and other variables d_4 (especially terms of trade). Finally, equations (8) and (9) are definitional: MB is the monetary base, comprising net foreign assets NFA and domestic credit DC. The equations (1), (2), (4), (5), (8), and (9) impose restrictions on the behavior of DC. Therefore, a separate equation for DC is not needed.

^{10/} For a general framework describing the determination of interest rate in developing countries, see Sebastian Edwards and Mohsin S. Khan (1985).

Short-Term Monetary Disequilibrium

10. Equations (1)-(9) are stylized in nature: functional forms, lag patterns and detailed variable definitions are not explicitly specified, as these are better presented in the context of the empirical estimates. However, the above equations indicate clearly the modus operandi of the model. Money demands are determined by equations (1)-(3) and the money supply by equations (4), (8) and (9). Now assume there is an excess supply of money. One consequence, given an open capital account, is that there will be a capital outflow (equation 5). In addition, excess demand for goods will lead to increased imports, and also to higher domestic inflation (equation 6). The pressure on balance of payments will induce some degree of depreciation (equation 7) while interest rates will rise temporarily, reflecting the influence of expected depreciation in the determination of domestic interest rate (Equation 3). Equilibrium will obtain as nominal money demand rises in line with the permanently higher domestic price level, and as money supply falls via a reduction in net foreign assets (due to reserve outflows). Thus, the end result will be a higher price level and a depreciated exchange rate. Finally, depending on the source of the initial disequilibrium (e.g., an export boom, higher government spending) it is possible that real GDP may rise. In this case, a part of the adjustment will happen through an increase in the demand for money (in real terms) which will entail lower increases in the domestic price level and the nominal interest rate, and also a smaller rate of nominal exchange depreciation. However, this channel is not modeled here owing to the complexity of short-run GDP determination and paucity of quarterly data.

D. EMPIRICAL EVIDENCE AND POLICY IMPLICATIONS

11. The behavioral equations (1-7) are estimated for Indonesia using quarterly data over the 1983-87 period. The lag structure is obtained empirically by testing for the relative importance of a specific lag. All the equations are estimated using OLS. The use of simultaneous equation technique was constrained by the non-linear nature of some of the equations and the small number of degrees of freedom. The detailed results and a glossary of variable definitions are as follows.

Estimation Results

$$(1a) \quad \begin{aligned} IS3 = & 0.190 \text{ DISC} + 0.174 \text{ DISC}(-1) + 0.193 \text{ IFA3}(-2) + 0.501 \text{ IFA3}(-3) \\ & (3.387) \quad (2.982) \quad (1.546) \quad (3.602) \\ & - 0.021 \text{ POIL}(-3) + 0.177 \text{ INF}(-1) + 2.943 \text{ EXD3} \\ & (-2.185) \quad (1.850) \quad (4.690) \end{aligned}$$

Sample Period: 1984.2-1987.4, $\bar{R}^2 = 0.916$,

D.W. = 1.744,

t-ratios in parentheses.

$$(2a) \quad \begin{aligned} \text{Log } \overset{M1}{---} = & - 3.702 + 0.471 \text{ Log GDPQ} - 0.005 \text{ IS3} \\ \text{WPI} & (-3.125) \quad (2.553) \quad (-3.045) \\ & - 0.308 \text{ EXPINW} + 0.363 \text{ Log } \overset{M1}{---} (-1) \\ & (-3.308) \quad (1.850) \quad \text{WPI} \end{aligned}$$

Sample Period: 1983.2 - 1987.4, $\bar{R}^2 = 0.781$,

D.W. = 2.008.

$$(3a) \quad \begin{aligned} \text{Log } \overset{QMD}{---} = & - 28.968 + 0.013 \text{ IS3} + 0.034 \text{ IS3}(-2) - 0.029 \text{ IFA3}(-3) \\ \text{WPI} & (-10.095) \quad (1.770) \quad (4.894) \quad (-2.827) \\ & - 0.016 \text{ INF}(-2) + 5.522 \text{ Log GDPQ}(-2) + 0.002 \text{ POIL}(-2) \\ & (-1.141) \quad (9.453) \quad (1.477) \end{aligned}$$

Sample Period: 1982.4 - 1987.4, $\bar{R}^2 = 0.982$,

D.W. = 2.107.

$$(4a) \quad \text{Log MM} = 0.965 + 0.437 \text{ Log } \overset{\text{QMD}}{\text{---}} + 0.009 \text{ IS3} \\ (10.859) \quad (11.351) \quad \text{M1} \quad (1.528)$$

Sample Period: 1983.4 - 1987.4, $\bar{R}^2 = 0.891$,

D.W. = 2.262.

$$(5a) \quad \text{DNFA} = -1.695 - 2.903 \text{ Log REER}(-4) + 3.911 \text{ Log POIL}(-1) \\ (-0.455) \quad (-4.032) \quad (8.101)$$

$$+ 0.539 \text{ NEDM} + 2.942 \text{ NFB} \\ (2.688) \quad (10.488)$$

Sample Period: 1984.1 - 1987.4, $\bar{R}^2 = 0.894$,

D.W. = 2.073.

$$(6a) \quad \text{D Log WPI} = 0.567 \text{ D Log IMPP} + 0.259 \text{ D Log (M2)} \\ (8.374) \quad (4.280)$$

$$+ 0.159 \text{ D Log RPRI}(-3) - 0.182 \text{ EDM}(-3) \\ (2.592) \quad (-2.406)$$

AR(1) coefficient: 0.485
(1.716)

Sample Period: 1984.2 - 1987.4, $\bar{R}^2 = 0.854$,

D.W. = 1.821.

$$(7a) \quad \text{D Log (NEER)} = -5.690 + 0.226 \text{ D Log POIL}(-1) - 0.940 \text{ INF} \\ (-1.445) \quad (6.490) \quad (-1.427)$$

AR(1) coefficient: 0.758
(4.359)

Sample Period: 1983.4 - 1987.4, $\bar{R}^2 = 0.928$,

D.W. = 2.414.

where

IS3 = 3-month state bank's time deposit rate;

DISC = Bank Indonesia discount rate;

IF3 = 3-month LIBOR rate;

IFA3 = IF3 + Bank Indonesia 3-month swap rate;

POIL = oil price (in US dollars);

- EXD3 = dummy variable, taking the value of 1 for 1987.3 (the 'Sumarlin shock'), and 0 otherwise;
- M1 = narrow money (currency outside banks + demand deposits);
- WPI = wholesale price index (excluding oil and gas)
- GDPQ = real quarterly GDP (obtained from annual series by linear interpolation);
- EPINW = expected inflation rate (proxied by previous four-quarters' WPI inflation rate);
- QMD = rupiah quasi-money (rupiah time and savings deposits);
- MM = money multiplier (ratio of M2 (= M1 + QMD) to reserve money);
- DNFA = change in net foreign assets of Bank Indonesia;
- NEDM = nominal excess demand for money (sum of fitted values of M1 and QMD, derived from equations (2) and (3) and converted to nominal term, minus actual M2 of preceding period);
- NFB = net official long-term foreign borrowing;
- D Log X = rate of change of any variable X;
- IMPP = import price index (import prices measured in domestic currency);
- KPRI = wholesale price of rice;
- EDM = excess demand for real money balances (defined as logarithm of real (deflated by WPI) fitted values of M1 + QMD, as derived from equations (2) and (3), minus logarithm of real M2 of preceding period);
- NEER = nominal effective exchange rate (defined so that an increase represents an appreciation of the rupiah);
- REER = real effective exchange rate
- INF = inflation differential between Indonesia and her trading partners (a series compiled by the IMF using CPI measures).

12. We proceed now to a brief discussion of the individual equations. In equation (1a), the domestic interest rate is determined as a function of the swap-adjusted foreign interest rate, the central bank's discount rate, the price of oil and inflation differential between Indonesia and her trading

partners.^{11/} A dummy variable is added to capture the effect of temporary monetary measures taken during the third quarter of 1987 to counter speculative capital outflows. The swap premium provides some indication of likely exchange rate change, and also provides protection against exchange risk to those who have access to the swap facility.^{12/} Other determinants of expected depreciation include the inflation differential and the price of oil (Indonesia's major commodity export). The discount rate is used as a proxy for Bank Indonesia's monetary policy stance. Although the discount window has been used less frequently, the discount rate is strongly correlated with interest rates on other money market instruments. The estimation results show that the foreign interest rates have a strong influence on domestic interest rates. Similarly, factors that affect expected depreciation have a significant impact on domestic interest rates. These results confirm the importance of paying attention to the role of foreign factors in determining interest rate policy in an open economy like Indonesia.

13. Equations (2a) and (3a) are fairly standard demand functions for narrow money and for quasi-money: as expected, the income-elasticity of demand for the latter significantly exceeds that for the former. Expected inflation enters significantly in equation (2a) and domestic and foreign (swap-adjusted) interest rates in equation (3a). While not quite significant, unlagged IS3 was retained in equation (3a) to maintain symmetry with equation (2a), and the

^{11/} Because expected depreciation is not observable, we have used the determinants of expected depreciation (swap premium, price of oil and inflation differential between Indonesia and her trading partner) in the interest rate equation.

^{12/} The swap premium was changed only twice during the sample period, indicating that it can properly be regarded as an exogenous variable for estimation purposes.

POIL and INF terms (which reflect exchange rate expectations) were retained to maintain symmetry with the reasoning underlying equation (1a). In equation (4a), for the money multiplier, various interest rates were experimented with, but without success. In fact, over the sample period, it follows a rather sustained upward trend, in line with the sustained growth of $\frac{QM}{M1}$ (QM requiring a smaller currency backing than M1).

14. As earlier stated, equations (5a), (6a), and (7a), among other things, serve to 'close the system' by showing the various ways in which it responds to monetary disequilibria. In equation (5a), an excess demand for money has a positive effect on DNFA, presumably by inducing inflows on both capital and current account. Moreover, an appreciation of the real exchange rate impinges adversely on DFNA; the length of the lag suggest that this effect works primarily through induced changes in the current account. Real GDP was also introduced into the equation, but it proved to be insignificant: its effect on money demand is incorporated in the NEDM term, while its effect on the current account is apparently ambiguous, since it positively affects both imports and exports (since GDP growth in the sample period was significantly export-focussed). Finally, the positive effect of POIL on DNFA may reflect either a capital inflow (on account of improved exchange rate expectations) or an improved current account, or both.

15. Equation (6a) indicates that inflation is generated by both cost-push and demand-pull factors. The rather high coefficient on import price increases may reflect the influence of expectational effects as well. The significant (although small) coefficient on D Log M2 may reflect the fact that in an inside-money economy increases in M2 are accompanied by increases in bank lending, and hence increases in the level of economic activity and

prices.^{13/} Finally, the fairly long lag associated with EDM appears to be consistent with empirical findings for other countries.^{14/}

16. Equation (7a) may be viewed as a 'policy reaction function' for the exchange rate. Increases in oil prices will induce an exchange rate appreciation, and vice versa.^{15/} The exchange rate is also manipulated for the purpose of maintaining competitiveness in the face of an excess of domestic over foreign inflation. The point estimate of -0.94 for the INF coefficient is close to the value of -1.00 that one would expect on theoretical grounds. Also, the empirical results confirm that the Indonesian authorities have taken into consideration the movement of world oil prices in undertaking exchange rate adjustments. Thus, lower oil prices in recent years have induced a real depreciation of the Indonesian rupiah.

^{13/} It may appear that inclusion of both $D \log M2$ and $EDM(-3)$ involves a double-counting of monetary influences. This, however, is not the case: conceptually, the $D \log M2$ term reflects the effect of the process (multiple credit creation) through which the money supply is expanded, while the $EDM(-3)$ term reflects the effect of people's subsequent portfolio adjustments to an excess demand or supply of money. A seller of goods and services may initially keep his sales proceeds in monetary form (while still raising prices if his sales are doing well), and only subsequently eliminate his excess money holdings.

^{14/} See, for example, J. Carr and M.R. Darby (1981).

^{15/} This is the standard 'Dutch disease' phenomenon. See J.P. Neary and S. van Wijnbergen (1988).

Policy Implications

17. Steady State Properties: As a point of departure for the policy discussion, let us first characterize the possible 'steady-state' equilibrium paths that emerge from the model. Suppose that exogenous variables such as the foreign price of oil, other foreign tradeable prices, and the foreign interest rate are constant. The monetary authorities will still have the freedom of determining the equilibrium domestic inflation rate: once this is fixed, all other variables such as the equilibrium rate of monetary expansion and the equilibrium rate of exchange rate change will be determined accordingly.

18. Now, both excessively 'low' and 'high' inflation rates are economically undesirable. Excessively low rates tend to hinder the adjustment of relative prices in response to 'normal' shifts in supply-demand conditions facing individual goods if absolute prices are sticky downwards. Excessively high rates of inflation have two adverse consequences: first, by taxing the public's currency holdings, they distort the choice between currency and other forms of asset-holding; and second, as an empirical matter it has been found that the variability of relative prices is positively correlated with the rate of inflation, and considerable relative price variability tends to interfere with the efficient allocation of resources.^{16/}

19. Our 'guesstimate' is, therefore, that a steady-state inflation rate in the range of 6-7% per annum will probably be appropriate, although the subsequent discussion is equally applicable to alternative choices of the target inflation rate. Suppose, then, that a target rate of 7% is selected.

^{16/} See M. Friedman (1977).

To maintain competitiveness (assuming world inflation rate of 2%), the exchange rate would then have to depreciate at 5% per annum. The domestic interest rate would exceed the foreign interest rate by 5%, and the swap premium would have to be set at 5%. The rate of monetary expansion would be equal to 5% plus the rate of growth of real GDP times the income-elasticity of demand for money.^{17/} Having determined the rate of monetary expansion, the rate of reserve-money growth over time is determined via the money multiplier. Lastly, the central bank can determine the proportion of this reserve money growth that is achieved through the growth of its net foreign assets through its own sterilization-cum-credit-creation policies.

20. Let us suppose now that this steady state is perturbed by a fall in the oil price. Ipso facto, this will result in a fall in DNFA, and hence the money supply will rise more slowly. However, it will also result in a

^{17/} This can also be seen by a simple manipulation of equation (6a). In the steady state, $D \log IMPP$ and $D \log RPRI$ would have to equal $D \log WPI$ ($IMPP$ refers to import prices in domestic currency). In the steady state, therefore, equation (6a) can be expressed as: $0.274 D \log WPI = 0.259 D \log M2 - 0.182 EDM(-3)$. Since the coefficients 0.274, 0.259, and 0.182 are close, they can be set equal to each other (formal t tests, at the 5 and 10 percent significance levels, confirm this), and the equation then reduced to $D \log WPI = D \log M2 - EDM(-3)$. Since EDM is defined as the logarithm of real money demand minus the logarithm of the previous period's real money supply, in the steady state it is equal to the rate of growth of real money demand, which is simply equal to the rate of growth of real income times the income-elasticity of real demand for money. Notice that the income-elasticity may change gradually over time as the share of $M1$ and of QMD in $M2$ change.

reduction in the rate of growth of real GDP, and hence money demand will also grow more slowly. It is not clear which influence will predominate, in either the short run or the long term, but in any event a partial analysis of this nature is not likely to be particularly useful. Of greater interest is the combined effect of the oil price decline and of the possible policy responses to it.

21. Effects of a Devaluation: One possible response is to devalue the rupiah, with the intention of boosting non-oil exports and thereby bringing about a recovery in the GDP growth rate over the medium term. Since ours is a short-run monetary model, we can only comment on the short-term monetary consequences of such a policy. From equation (6a), a devaluation can be seen to be rather inflationary: a one percentage point change in D Log IMPP brings about a 0.6 percentage point change in D Log WPI. Thus, a one percentage point change in the real exchange rate will require a 2.5 percentage point change in the nominal exchange rate, which will be accompanied by a 1.5 percentage point change in the WPI. This illustrates the familiar textbook result that devaluation needs to be combined with demand management measures to achieve a sustained real depreciation without generating cost-push inflation. Indeed, Indonesia's recent adjustment experience suggests that a real exchange rate depreciation was achieved by combining devaluation with budget austerity. As a result, real growth declined in the short term.^{18/}

22. Monetary Policy. Another possible response may be to reduce domestic interest rate via expansionary monetary policy to boost private investment and economic growth. Although this could be implemented in various ways, let us

^{18/} See Ahmed, op.cit.

assume this is done by a reduction in Bank Indonesia's discount rate (all other related instruments also are assumed to reflect this). Money supply expands via increase in reserve money and domestic interest rate falls (equation 1a). This reduction in the domestic interest rate is, however, only temporary. A lower interest rate reduces the demand for real quasi-money (equation 3a) and, in combination with higher money supply, leads to a situation of excess money supply. Inflation tends to increase (equation 6a) and there is capital outflow (equation 5a). Equilibrium is restored when the excess money supply is dissipated via loss of reserves and a higher price level. To prevent a continuous loss of reserves, the Government will have to realign its discount rate (and interest rates on other related monetary instruments) to its equilibrium level. Thus, over the longer term, nominal and real interest rates come back to their original levels.

23. Combined Policy Response. The most effective policy response to a permanent reduction in the price of oil would be to combine an initially tight monetary and fiscal policy with a depreciating exchange rate. The demand reduction policies may reduce short-term real growth, but devaluation will have a favorable impact on growth by boosting exports. The mix of demand reduction and expenditure switching policies will also reduce the macroeconomic imbalances and the economy's dependence on oil. The growth momentum can be restored over the medium term by bringing efficiency improvements through regulatory reforms, by maintaining the competitiveness of the real exchange rate, and by letting domestic liquidity to expand in line with the demand for money and an appropriate inflation target. Indonesia's recent experience suggests that its adjustment to the massive decline in oil prices has followed a broadly similar strategy. A sharp depreciation of the real exchange rate and reduction in domestic inflation have allowed Indonesia

to bring about significant reduction in macroeconomic imbalances. Economic growth has decelerated but there are encouraging signs that the economy is moving towards recovery supported by a strong non-oil export performance (responding to real exchange depreciation and complimentary trade reforms) and a sustained deregulation drive aimed at enhancing economic efficiency. Private investment (domestic and foreign) is now increasing, responding to improved business environment.

E. CONCLUDING REMARKS

24. The key results of this paper may be summarized as follows:

- (a) Indonesia's open capital account requires that monetary policy be coordinated with other policies aimed at managing the balance of payments.
- (b) In particular, domestic interest rates are closely linked to foreign interest rates. The efficacy of monetary policy in reducing interest rates through monetary expansion is very limited.
- (c) In the short term, monetary policy can be used to protect domestic interest rates from destabilizing influences of speculative capital flight. Over the longer term, monetary policy can contribute to lowering domestic nominal interest rates by maintaining low inflation rates and thereby dampening depreciation expectations.
- (d) Domestic inflation is partly a monetary phenomenon but structural factors also affect inflation. The main structural variables are the domestic price of imports and the price of rice (used as a proxy for wage adjustments). The transmission of international inflation

is immediate and quite large, but wage push effects are small and have a longer adjustment period.

- (e) The positive influence of monetary variables on domestic inflation suggests that inflation can be reduced to some extent by slowing the growth of money. This primary effect is strengthened by the secondary influence of a slower pace of exchange rate crawl.
- (f) A policy of managed float is appropriate to maintain the competitiveness of the exchange rate, given the divergence between world and domestic inflation caused by structural and monetary factors. A real depreciation of the exchange rate will also be required to compensate for a further loss of oil income (decline in oil prices).

25. In conclusion, the limitations of the present study should be borne in mind. Our model is a short-run one and will have to be complemented by a medium-run model. In particular, an endogenous output response and an explicit current account determination will be essential to strengthen the conclusions of this study. Nevertheless, the study has yielded some meaningful results which are well supported by a strong body of economic theory.

BIBLIOGRAPHY

- Ahmed, Sadiq (1989). Indonesia External Shocks. Policy Response and Adjustment Performance. Report No. IDP39, Asia Regional Series, World Bank, Washington D.C.
- Balino, Thomas and V. Sunderarajan (1986). "Financial Reform in Indonesia, Causes, Consequences and Prospects" in Financial Policy and Reform in Pacific Basin Countries", edited by Hong-Sheng, Lexington Books, Massachusetts.
- Carr, J. and M.R. Darby (1981). "The Role of Money Supply Shocks in the Short-Run Demand for Money", *Journal of Monetary Economics*, Vol. 8, No.2.
- Edwards, S. and M.S. Khan (1985). "Interest Rate Determination in Developing Countries: A Conceptual Framework", Staff Papers, IMF, Washington, D.C.
- Gelb, Alan and Associates (1988). Oil Windfalls Blessing or Curse, Oxford University Press (published for the World Bank).
- Frenkel, J.A. and H.G. Johnson (ed.)(1976). The Monetary Approach to the Balance of Payments, George Allen and Unwin, London.
- Friedman, Milton (1977). "Nobel Lecture: Inflation and Unemployment", *Journal of Political Economy*, Vol. 85, No. 3.
- Neary, J.P. and S. van Wijnbergen (ed.)(1986). Natural Resources and the Macroeconomy, Basil Blackwell Ltd., Oxford.
- Suwidjana, Njoman (1984). Jakarta Dollar Market: A Case of Financial Development in ASEAN, Occasional Paper No. 76, Institute of Southeast Asian Studies, Singapore.
- Warr, Peter G. (1986). "Indonesia's Other Dutch Disease: Economic Effects of the Petroleum Boom", in Natural Resources and the Macroeconomy, edited by Neary and van Wijnbergen, Basil Blackwell, Oxford.

PFE Working Paper Series

	<u>Title</u>	<u>Author</u>	<u>Date</u>	<u>Contact for paper</u>
WPS333	An Option-Pricing Approach to Secondary Market Debt (Applied to Mexico)	Stijn Claessens Sweder van Wijnbergen	January 1990	S. King-Watson 31047
WPS334	An Econometric Method for Estimating the Tax Elasticity and the Impact on Revenues of Discretionary Tax Measures (Applied to Malawi and Mauritius)	Jaber Ehdaie	February 1990	A. Bhalla 37699
WPS335	Macroeconomic Adjustment and the Labor Market in Four Latin American Countries	Ramon E. Lopez Luis A. Riveros	December 1989	L. Riveros 37465
WPS336	Complementary Approaches to Financing Health Services in Africa	Germano Mwabu		
WPS337	Projecting Mortality for All Countries	Rodolfo A. Bulatao Eduard Bos Patience W. Stephens My T. Vu	December 1989	S. Ainsworth 31091
WPS338	Supply and Use of Essential Drugs in Sub-Saharan Africa: Issues and Possible Solutions	S. D. Foster		
WPS339	Private Investment and Macroeconomic Adjustment: An Overview	Luis Serven Andres Solimano	December 1989	E. Khine 37469
WPS340	Prudential Regulation and Banking Supervision: Building an Institutional Framework for Banks	Vincent P. Polizatto	January 1990	WDR Office 31393
WPS341	Cost-of-Living Differences between Urban and Rural Areas of Indonesia	Martin Ravallion Dominique van de Walle	December 1989	C. Spooner 30464
WPS342	Human Capital and Endogenous Growth in a Large Scale Life-Cycle Model	Patricio Arrau	December 1989	S. King-Watson 31047
WPS343	Policy Determinants of Growth: Survey of Theory and Evidence	William R. Easterly Deborah L. Wetzel	December 1989	R. Luz 61588
WPS344	Policy Distortions, Size of Government, and Growth	William Easterly	December 1989	R. Luz 61588
WPS345	Private Transfers and Public Policy in Developing Countries: A Case Study for Peru	Donald Cox Emmanuel Jimenez	December 1989	A. Bhalla 37699

PRE Working Paper Series

	<u>Title</u>	<u>Author</u>	<u>Date</u>	<u>Contact for paper</u>
WPS346	India's Growing Conflict between Trade and Transport: Issues and Options	Hans Jurgen Peters	January 1990	T. Lim 31078
WPS347	Housing Finance in Developing Countries: A Transaction Cost Approach	Robert M. Buckley	December 1989	WDR Office 31393
WPS348	Recent Trends and Prospects for Agricultural Commodity Exports in Sub-Saharan Africa	Takamasa Akiyama Donald F. Larson	December 1989	D. Gustafson 33714
WPS349	How Indonesia's Monetary Policy Affects Key Variables	Sadiq Ahmed Basant K. Kapur	February 1990	J. Rompas 73723
WPS350	Legal Process and Economic Development: A Case Study of Indonesia	Cheryl W. Gray	December 1989	B. Dhomun 33765
WPS351	The Savings and Loan Problem in the United States	Stanley C. Silverberg	February 1990	WDR Office 31393
WPS352	Voluntary Export Restraints and Resource Allocation in Exporting Countries	Jaime de Melo L. Alan Winters		
WPS353	How Should Tariffs be Structured?	Arvind Panagariya		
WPS354	How Commodity Prices Respond to Macroeconomic News	Dhaneshwar Ghura	February 1990	S. Lipscomb 33718
WPS355	The Evolution of Credit Terms: An Empirical Study of Commercial Bank Lending to Developing Countries	Süle Ozler	February 1990	S. King-Watson 31047
WPS356	A Framework for Analyzing Financial Performance of the Transport Sector	Ian G. Heggie Michael Quick	February 1990	W. Wright 33744
WPS357	Application of Flexible Functional Forms to Substitutability among Metals in U.S. Industries	Ying Qian	February 1990	S. Lipscomb 33718
WPS358	An Analysis of the Aggregate Long- Term Behavior of Commodity Prices	Pier Giorgio Ardeni Brian Wright		
WPS359	A Survey of Recent Estimates of Price Elasticities of Demand for Transport	Tae H. Oum W. G. Waters, II Jong Say Yong	January 1990	W. Wright 33744